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a Missing Link

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The Role of Governance in Cluster Typologies: A Missing Link

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1. Introduction

The main purpose of the paper is to develop the analysis of governance structures within clusters. The main focus will be on power relations shaping the evolution of clusters, not least the interaction between multi-national corporations (MNCs), local companies and local universities. This requires digging further into the analysis of power within clusters than, according to our knowledge, done previously in the literature. The ultimate aim of the research is to facilitate internationally comparative studies of cluster architectures and the main factors behind cluster evolution.

A considerable amount of confusion is surrounding the definition and use of the term cluster. A plethora of papers have applied different definitions of clusters, c.f. Martin and Sunley (2003). There are on the other hand only a rather limited amount of contributions to more systematic studies of typologies of clusters in the literature. Among these, power relations usually play only a minor or an implicit role. It appears rather obvious that large locally headquartered firms may have a more significant role to play in cluster evolution than small local players. However, it is probably in a rather limited amount of cases that power relations may be represented as a simple function of firm size.

Among the contributions in the literature to cluster/district typologies the now classical paper by Markusen (1996) on 'Sticky Places in Slippery Space' takes firm size and, accordingly, power into account. Besides the well known 'Italian district', she introduced power derived from large scale in terms of private firms (hub-and-spoke districts) or government bodies (state anchored districts). The opposite of the latter two categories, regions with many affiliates of firms headquartered elsewhere, she dubbed satellite platform districts. From the perspective of the present paper we have found these categories to be too stereotyped. Many real world clusters/districts may be more amply characterized as various kinds of mixes in between these four stylized categories. Markusen's paper opens for this perspective and that will be pursued more systematically below.

In Section 2 we give a short overview of the literature on definition and typologies of clusters. While there is a lack of focus on power in the literature on clusters and industrial districts, the literature dealing with global production networks (GPNs) has discussed power in relation to regional development. In section 3 we integrate the GPN literature on global production networks with the discussion of cluster categories. A

categorization of clusters is developed focusing on the presence of MNC headquarters, MNC affiliates and local companies. Section 4 contains a more systematic discussion of the role of power within clusters inspired from political science and sociology. The discussion builds on theoretical considerations on the one hand and findings from previously published and recent case study material. Section 5 presents the findings and section 6 the conclusions.

2. Cluster definitions and typologies

Two issues seem appropriate to clarify before moving on to the specific agenda concerning the role of governance in cluster evolution. First, how are clusters defined in the literature? The most widespread definition has been put forward by Porter:

"Clusters are geographic concentrations of interconnected companies, specialized suppliers, service providers, firms in related industries, and associated institutions (for example, universities, standards agencies, and trade associations) in particular fields that compete but also corporate." (Porter 1998, p.197-198)

This specification is very broad and elastic.[1] The intensive interest in the concept and applied research in the field from many different academic directions have resulted in a literature, which to a certain extent can be characterized as a terminological soup (Lorenzen 2005). According to Martin and Sunley at least the following concepts are at play: 'industrial districts', 'new industrial spaces', 'territorial production complexes', 'neo-Marshallian nodes', 'regional innovation milieu', 'network regions' and 'learning regions'.

We will argue for a fairly pragmatic – but rather narrow - application of Porter's definition. Clusters are geographic concentrations of firms and closely related institutions (such as universities and trade associations) within the same 'sphere of businesses'. The term cluster should be reserved for only those agglomerations of firms that share a rather well defined common knowledge base and a joint labour market. The term has been abused for all sorts of initiatives in the aftermath of the Porterian fashion wave in cluster development efforts. Although it has received a kind of miracle drug status in the general public, we are still convinced that sober and modest application of the term may actually serve as a valuable analytical tool for applied oriented research in the field of industrial development and economic geography.

In a recent paper, Belussi (2006) presented a rather extensive analysis of the potential semantic ambiguity observed in the literature on clusters versus industrial districts. Belussi observed that many contributions apparently consider the terms clusters and industrial districts to be substitutes. However, the term industrial district appears, at least in the Italian literature, to be reserved for agglomerations dominated by small firm networks with considerable social interaction between the actors.

Although the critical remarks on the plethora of different versions of Porter's clusters may be well taken, the paper does not leave the reader with a clear point of departure concerning the second issue to be clarified in the present paper concerning cluster typologies. Belussi (2006, p.85) claims that the advantage of her approach is to "…avoid fanciful typologies, like the one proposed by Markusen (1996)."

[1] (Martin & Sunley 2003) presents an extensive and critical review of the literature of cluster definitions, although they do not themselves offer an operational definition.

On the contrary, we find that Markusen's paper still holds the key to the most relevant classification scheme. She introduced a typology of four districts (not 'clusters') based on extensive empirical research. The categories were:

(1) The Marshallian New Industrial District (NID) with its recent 'Italianate form'.

(2) Hub-and-spoke districts.

(3) Districts based on satellite industrial platforms.

(4) State-anchored districts.

Markusen opens for analyzing the real world districts as 'sticky mixes' of the four categories as well as some features of dynamics over time in terms of districts on the move from one category to another.

The more recent contributions to the typology literature may at first glance appear more theoretically sophisticated, but do not necessarily lead to more applicable categories for empirical studies. Immarino & McCann (2006) presents a transactions cost based classification as the baseline and extends and transforms it into a 'knowledge based taxonomy of clusters' containing: (1) pure agglomeration, (2) industrial complex and (3) social networks divided into so-called (3a) old social networks and (3b) new social networks. This contribution is primarily a deductive effort and is rather loosely illustrated by a set of pretty broadly defined cases of 'clusters', such as Silicon Valley, Silicon Glen in Scotland, biotechnology and media clusters, Italian industrial districts and the City of London. The categories appear too broadly defined and the examples vary a great deal in their level of aggregation.

From our point of view it may be more fruitful – and necessary – to disentangle the perception of e.g. the 'cluster above all clusters', Silicon Valley. It actually presents itself as consisting of seven industry clusters of which the most famous is semiconductors (ex. Intel, AMD and Allied Materials).[2] Even at this more disaggregate level a lot of borderline issues may be raised; no objective or 'scientific' methodology can claim to be the best fit for such delimitation efforts. At the bottom line this will have to be a practical issue guided by a combination of knowledge about given industries, their business environment and the applied technologies. To claim close connections between, say, Intel and Google in the Silicon Valley case does not appear to be a workable point of departure for more focused cluster studies. They can, however, more fruitfully be claimed to be components of a larger *regional innovation system* (encompassing either Santa Clara County or maybe more relevant the entire Bay Area) as originally coined by e.g. Cooke (1992; 2001) and applied extensively in a European context in e.g. Brazcyk et al. (1998).

In another recent paper aiming at constructing a new typology of industrial districts, Paniccia (2006) flagged a pretty high level of ambition in the title: "Cutting through the chaos". Both Markusen's and a predecessor to Iammarino and McCann's paper, c.f. Gordon and McCann (2000) are referred to as 'milestone', but they are basically not discussed. Instead is presented a typology that is "intended to encompass the largest possible number of real forms in different socio-cultural contexts" (p. 92), although the typology is not claimed

[2] www.siliconvalleyonline.org. The remaining six are: Computers and Communications Hardware (ex. HP, Cisco, Sun); Other Electronic Components (ex. Flextronics, Solectron); Software (ex. eBay, Google, Symatec, Siebel and Borland); Biomedical (ex. Genencor, Varian Medical); Innovation & Creative Services (ex. Electronics Arts, DreamWorks Animation) and Nano-bio-info Technology Convergence .

to be exhaustive. What then is presented are six categories of clusters or industrial districts (IDs): (1) (semi)canonical IDs[3], (2) diversified or urban IDs, (3) satellite platforms or hub and spoke agglomerations, (4) co-locations areas, (5) concentrated or integrated agglomerations or IDs and (6) science-based or technology agglomerations. Although it is a merit of the paper that it offers a detailed scheme of factors that vary between these six categories, the reader appears to be left with a typology with many overlaps between the categories and a peculiar reservation of science-based IDs in one category of its own.

In our view the original Markusen classification is still the most appropriate for applied comparative research on clusters. We see no specific merit in isolating the science-based clusters in one category. On the contrary, this part of the industrial spectrum may have many common features with other kinds of clusters. Our point of departure will be that a classification effort should cut across the entire industrial spectrum.

In our reading of the literature there is however a missing link in these classification exercises. The power relations within clusters have not been dealt with systematically *per se*, apart from taking firms size into account. Our main focus is to explicitly discuss the role of multinational companies (MNCs) in the evolution of clusters. We will distinguish between clusters anchored around one MNC with or without a home base in the region, and clusters containing several affiliates of MNCs mixed with local SMEs.

While there appears to be a lack of focus on this kind of power relations in the literature on clusters and industrial districts, a body of literature dealing with global production networks has approached this phenomenon.

3. Global production networks and clusters

According to Coe et al. (2004) we can understand an industry as a collection of global production networks. Some of these intersect at some points creating connections between different GPNs within one industry. An example could be within telecommunications where some of the large wireless equipment vendors (Nokia, Motorola, Samsung, etc.) may share some component suppliers. In other cases we may see GPNs within the same industry not directly connected. Regional development is shaped by both regional and extra-regional firms, such as focal firms.[4] For economic development to occur in this framework, a given region has to contain assets valuable for the actors in GPNs as well as regional institutions that can support the coupling between these local assets and the GPNs. This fits with findings from the literature on MNCs, such as (Cantwell & Santangelo 2002):

"In analysing MNCs' internationalisation strategy, it emerges clearly that multinationals target local *spatial areas* where they can enjoy externalities and knowledge spillovers as well as corporate control and a dynamic environment".

It is also recognized in the literature that MNCs may shape the evolution of regions as well as these, the other way around, may shape or at least influence the evolution of MNCs. The basic point is that power is distributed between the region and the GPNs, and it tends to be allocated towards focal firms. The result is that:

[3] Part of the terminology appears pretty inside Italian for the international audience.

[4] (Coe et al. 2004, p.473) defines focal firms as "...dominant firms spearheading the global organisation of production networks through their corporate and market power..."

"The more a region is articulated into global production networks, the more likely it is able to reap the benefits of economies of scale and scope in these networks, but the less likely it is able to control its own fate" (Coe et. al. 2004, p.475)

Institutions play a role in shaping the evolution of the interaction between GPNs and regional assets.

A cluster may (or may not) be valuable for players in the industry because of the presence (or absence) of some valuable 'externalities'. According to Brenner (2004), the self-augmenting processes occur in clusters. If these dynamics are valuable, GPN activities will be attracted to the cluster. In the opposite case, the GPNs will loosen their relations to the cluster, causing decline. A cluster containing the headquarters of one or more focal firms may have relatively large power to define it own fate, despite being deeply embedded within the GPNs constituting the industry. On the other hand, a cluster containing only externally controlled departments owned by foreign focal firms in the industry may lack sufficient power to control its own fate. In other words, regions, due to the configuration of their industries, can possess different amounts of power to shape their future

The problem in creating a classification according to this line of thought is, that we cannot equal the resources present in the region to its ability to shape its own future, since power is not a resource that is possessed (Foucault 1991). We can, however, say that regions containing the headquarters of a large player in the industry at hand possess greater resources and may therefore possess greater power in shaping their own future, compared to regions containing only few small players within the industry. Further, a region containing a cluster may be in a better position to shape its future than a region with only a few small firms. We distinguish between four types of regions divided according to two dimensions. The first is whether the region possesses the headquarters or home base of a large MNC within the industry. The second dimension focus on whether the region contains a cluster or not, as illustrated in Figure 1.

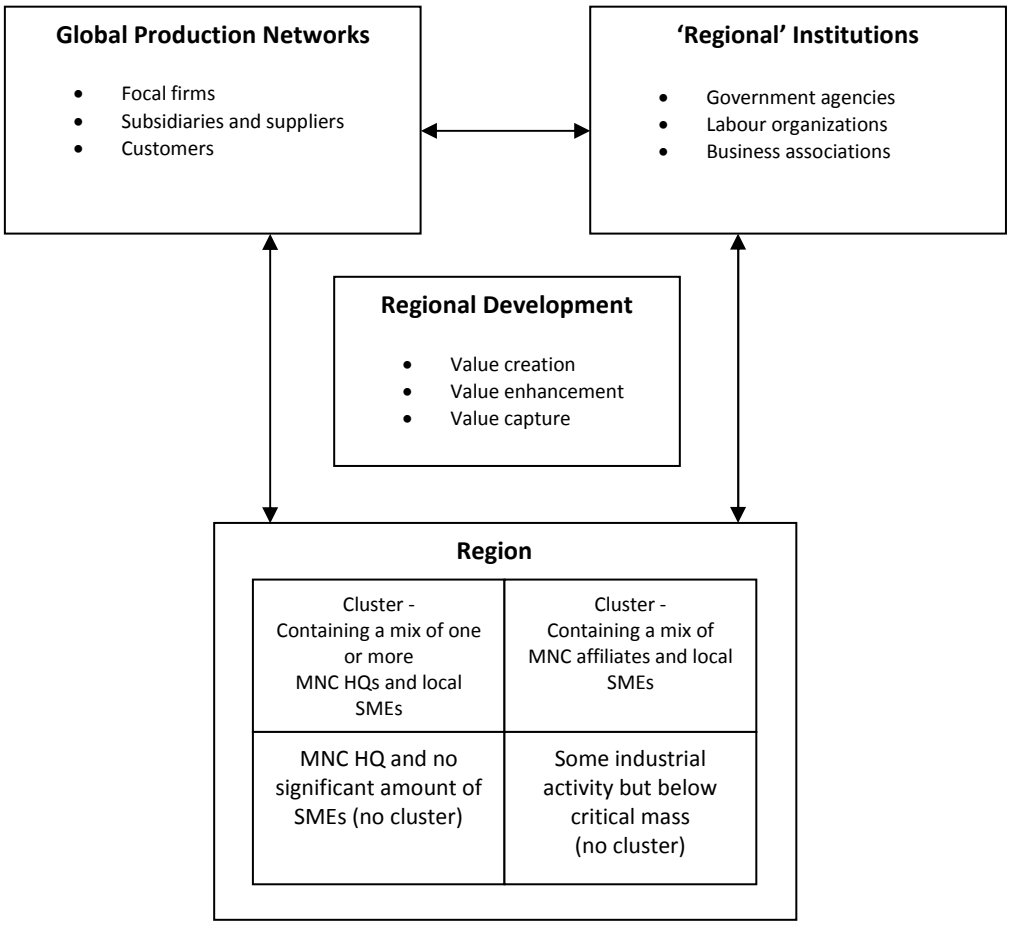

Figure 1 Interaction between global production networks and clusters. Inspired by (Coe et. al. 2004).

The first type is the region in the upper left corner, that possesses both a cluster as well as headquarter or home base of one or more large MNCs within the industry at hand. The second type in the upper right corner contains a cluster but without the presence headquarters or home base of a large MNC. The third type in the lower left corner contains the headquarters or home base of a large MNC but no cluster. This is the case of large company without a critical mass of smaller companies within the same or related industries around it. The fourth (lower right corner) possesses neither headquarters nor a critical mass of activities within an industry or related industries that can support self-augmenting processes.

These four types of regions possess different resource bases and thus potentially different amounts of power to shape their own future. However, we cannot deduct a priori that one of the four possesses more power than the others. What we can do however, is to develop a framework for analyzing the powers that shape the evolution of these different cluster types, and this will be focus of the next section.

4. Power relations within clusters

The cluster literature has largely ignored the notion of power. One of the exceptions is Bathelt & Taylor (2002), who states:

"... we argue that a deeper appreciation of the nature of the power that bind them together is key to understanding how clusters function – including how they might emerge and how they might decline" (Bathelt & Taylor 2002, p.94)

Most of the classical theories on power can, according to Clegg (1989), be traced back to Hobbes. These theories are preoccupied with possession, sovereignty and control. Another line of thought is the post-structural theory presented by Foucault who builds on Machiavelli and Nietzsche who focus on exercise, strategy and struggle (Foucault 1984;Foucault 1998).

Foucault describes two types of power: disciplinary power and bio-power. To be useful and fit in society, a person needs to be subjected to disciplinary practices. Disciplinary power builds on three elements: hierarchical observation, normalizing judgment and examination. When people are subjected to observation and judgment, they will adjust their actions according to what they believe the supervising part wishes, and hence the power of the supervising part (Foucault 1991). Bio-power work through *discursive practices* within populations that establish what is right or wrong, how people should or should not behave and what is normal or not. The point is, that in addition to being supervised by external parties (disciplinary power), individuals in a society also evaluate their own actions in relation to what they believe to be normal or right. They basically supervise themselves according to their notion of what is right and wrong, which they gain from the discursive practices they are part of. Hence the term bio-power, the power comes from within persons rather than been infected upon persons from the outside (Foucault 1998).

Subjects in society are always situated in a number of discourses that are constantly evolving, which is why "Power is everywhere; not because it embraces everything, but because it comes from everywhere" (Foucault 1998, p.93). It is important to notice, that there is no dominant discourse in society, instead discursive elements are constantly created, combined with existing elements or combined in new ways. No specific group defines a dominant discourse and hence controls the working of bio-power in society. Instead different individuals or groups create different discursive elements and combine them with existing elements in the quest to reach their goals. This process will then be challenged by other persons pursuing other goals using other discursive elements and so forth. The evolution of society should be understood as a never ending process, power relations will continue to evolve and new confrontations will continue to emerge.

The geographical extents of the discourses that effect the events within a cluster are not restricted to the spatial reach of its boundaries. On the contrary, many discourses are of a global or national character. The case study will for example show how discourses and related practices within the global telecommunications industry influence the discourses and related practices within the local NorCOM cluster concerning choice of technologies. Other discourses are mainly local in scope on e.g. which initiatives to be launched in relation to network activities among the actors in the cluster and how universities or science parks should support the companies.

The evolution of discourses is illustrated in Figure 2, which shows a cluster consisting of three local companies (circles), three MNCs (rectangles) and a university (triangle). Each of these may cause the creation and

survival of some discursive elements and related practices, indicated by the small circles, rectangles and triangles. The employees of each organization can produce and sustain multiple elements, and elements can also be created in corporation between members of different organizations and institutions. Discursive elements originating outside may also have an influence, for example originating in regional government institutions (diamonds), in the industry (hexagons) or in the global economy (pentagons).

The important point is that some elements become more used than others. They get a status where they are incorporated in the majority of the discourses and practices used by people in the cluster, and therefore also become difficult to avoid when persons within and outside the cluster create new strategies. In the evolution of a cluster a number of discursive elements and practices thus become dominant through their utilization in different strategies by the different actors, whereby a collection of discourses shaping the future of the cluster emerges. This is illustrated by the dotted circles. Such elements can for example deal with which technologies that should be the core of the cluster.

This collection of discursive elements and related practices is in constant evolution, new elements might be added, others might be left out, some may change a bit etc. Further, all persons may not subscribe to all elements. Some persons subscribe to some elements, other persons to other elements. The collection of discursive elements can further contain some elements that support each other and other elements that work against each other. Seen as a whole, this collection of discursive elements is what shapes the evolution of the cluster, because of the utilization of the elements in multiple strategies pursued by actors within and outside the cluster.

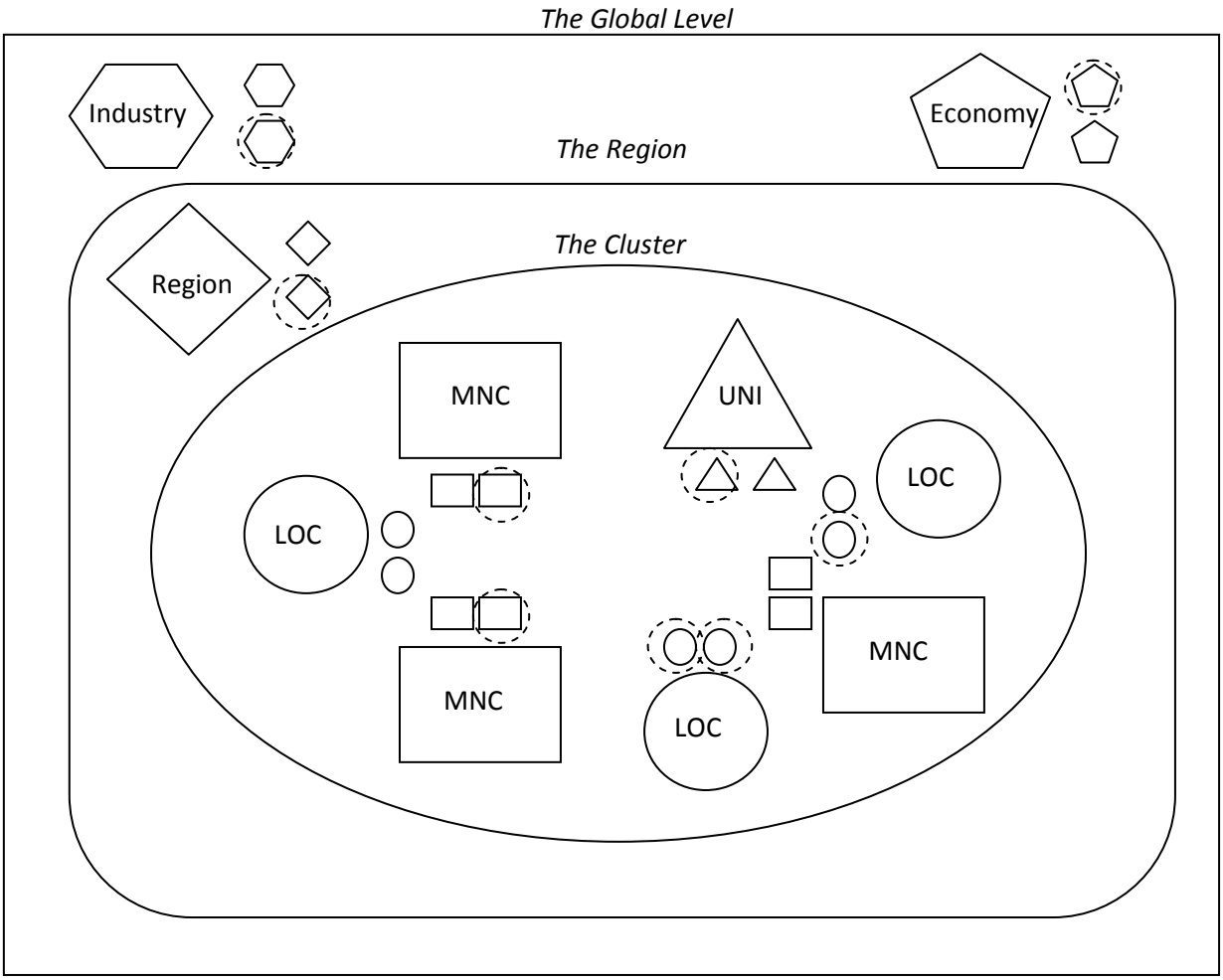

Figure 2 Illustration of cluster discourses – with MNC headquarters

We now turn to the different roles of MNC headquarters, MNC affiliates and local companies. A local company is able to decide for itself which strategies to pursue. It is relatively free to make strategies, which can then be challenged by actors within and outside the company. For the headquarters the challenge is the same, the CEO or board set a strategy, which can be challenged by people within the organization. An affiliate is in a different situation. The manager does not have the same freedom in setting strategies compared to a local company of similar size. The strategic possibilities of the manager vary according to whether the affiliate is relatively controlled from above or is a relatively autonomous within the MNC.

This difference between local companies, affiliates of MNCs and MNC headquarters is illustrated in Figure 3, which shows a cluster containing two local companies (circles), two affiliates of MNCs (rectangles) and a university (triangle). There is no MNC headquarters within the cluster. They are located outside in the 'global industry'. The dotted lines show which MNC each affiliate is part of, and the double pointed arrows indicate the power relations between the affiliate and MNC headquarter.

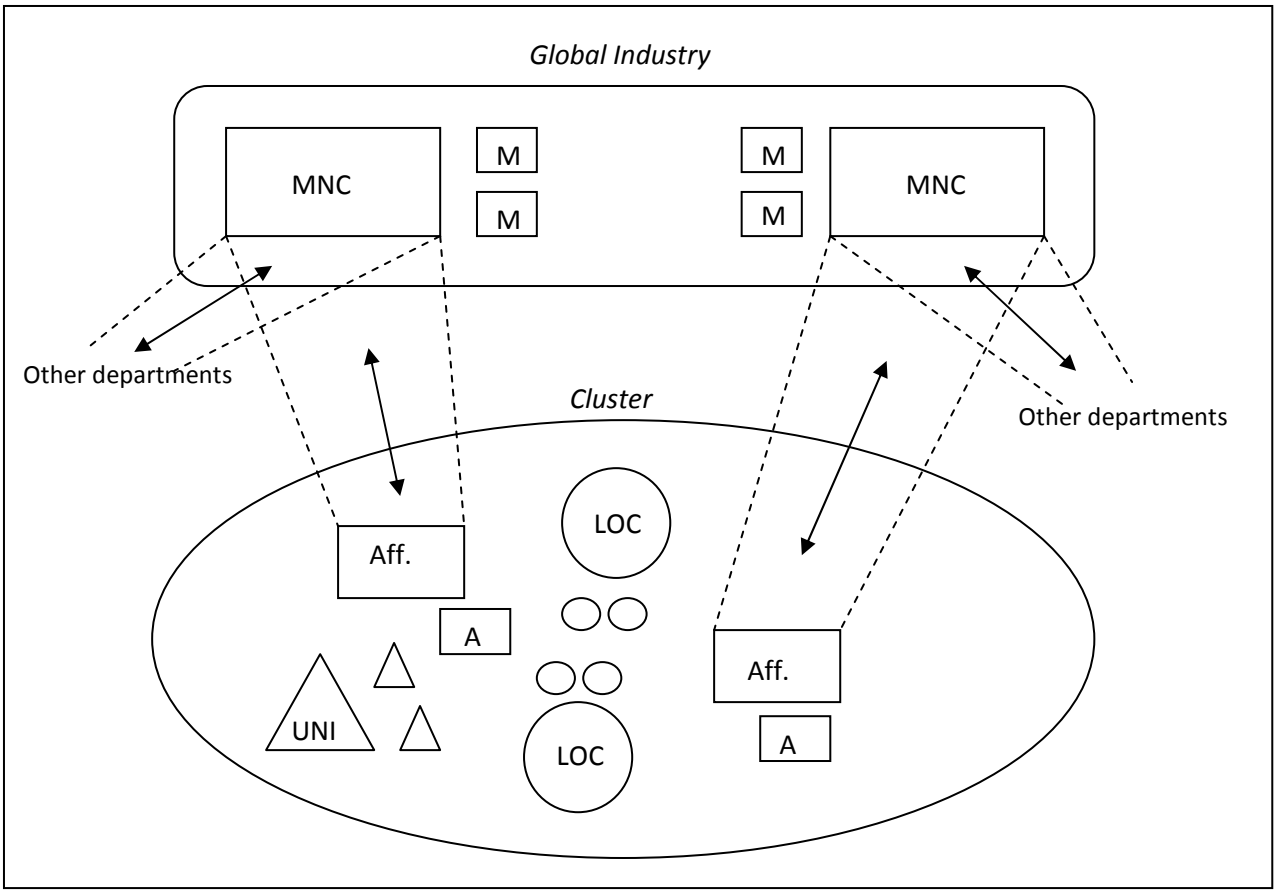

Figure 3 Illustration of cluster discourses – without MNC headquarters

The affiliates can be understood as coalitions within MNCs that do not necessarily share all the goals of the MNCs, but which is forced to follow some of the discourses produced by the headquarters. An example of a goal of an affiliate, not necessarily shared by headquarter, is to stay alive.

According to Becker (2004) rules, by their very nature, leave some room for manoeuvre, due to the discretion found in every rule. The employees in affiliates therefore have some possibilities of creating discourses and practices on their own. Discourses created by the headquarters are shown as the rectangular boxes marked M. Depending on whether the affiliate is relatively controlled or autonomous, the employees can create discourses on their own, indicated by the boxes marked A.

The important point is whether or not employees in affiliates choose to utilize this room for manoeuvre granted by discretion in the rules and orders given by headquarter. We know from the theory on disciplinary power that people exposed to continuous supervision, judgement and evaluation will try to adjust their action to what they believe is the wish of the supervising part. This mean, that employees in an affiliate, who are supervised, judged and evaluated by headquarter, could miss to utilize the freedom they are granted in the discretion of rules and orders issued from headquarter, because they are focusing their energy on fulfilling the wishes of headquarter. They might even end in a situation where they become so focused upon fulfilling the perceived wishes of headquarter, that they also start monitoring themselves according to, not only orders and rules actually given by headquarter, but also what they from different dis-

courses perceive as desirable action in relation to headquarter, see for example the previous discussion about bio-power. Therefore we cannot assume, that employees in affiliates will utilize their freedom, we can only say that they have the possibility. Whether or not they will use this freedom depends on the extent of the disciplinary power from headquarter. It is plausible that discourses within and outside the cluster can effect the employees in other directions than the disciplinary power found in relations to headquarter, i.e. to utilize the power they have to support for example the future evolution of the cluster. We therefore need, to understand the role of MNC affiliates in relation to cluster evolution, to focus on both the disciplinary power influencing the actions of employees in the affiliates, and the bio-power, i.e. the discourses within and outside the cluster, effecting actions of employees in the affiliates.

It may, thus, be dubious to perceive affiliates of MNCs as 'black boxes' that are controlled completely outside the cluster, which appears to be the case in Markusen's description of the satellite platform type of industrial districts.

5. Case Study – The evolution of the NorCOM cluster

First, we give a short introduction to the development and current state of the global wireless telecommunications industry, which forms the industrial context. Then we sketch the history and present situation of NorCOM. Finally, we discuss the most important events shaping the evolution of the cluster.

5.1 The wireless telecommunication industry

The concept of technological life cycles fits neatly the evolution of mobile communications technologies, c.f. Dalum et al. (2005). The significant changes in the basic technology from the first generation 1G technology, of which the Nordic Mobile Telephony system (NMT) became a leader, to the second generation 2G systems, GSM and CDMA, constitute a major shift of the technological life cycle. Similarly, the third generation systems UMTS and CDMA2000 represent the present cycle, which is close to a real take-off. The pattern shown in Figure 4 includes a sketch of the present perception of 4G version of the most dominant trajectory within mobile communications, the so-called 'ETSI-track', due to the dominant position of the EU European Telecommunications Standard Institute. At present a view of transformation of the 3G UMTS system into a so-called Long Term Evolution, LTE, has acquired considerable attention to be taken seriously.

The 1G cycle consisted of analogue mobile systems, of which the Nordic NMT became very successful. The disrupter and subsequent new technological life cycle was the pan-European GSM, which was a shift to digital technology and required a new infrastructure. The disruption caused by GSM did not only lead to replacement of NMT; GSM also became the dominant world standard. The massive investments required to build the new 3G infrastructure and the slow down of the international ICT industry during 2001-2003 has increased the focus on what is coming next in the horizon. Is there such a thing as a 4G system? How can it be defined? What are the options for a regional cluster of the NorCOM type to become competitive in this field? These are some of the most salient questions discussed in recent years within the industry and more broadly in the surrounding society at large.

Originally 4G has loosely been defined as the complete integration between the wired and the wireless spheres of telecommunications with speeds of data communications of 100 Mb/s and in operation in, say, 2010. There is however a certain ambivalence prevalent in the terminology at present. 'Premature' versions of 4G are much closer – in fact already available consisting of combinations of technologies based on wire-

less internet access technologies, such as WLAN (IEEE 802.11x) or WiMAX (IEEE 802.16x), embedded in laptops or mobile phones.

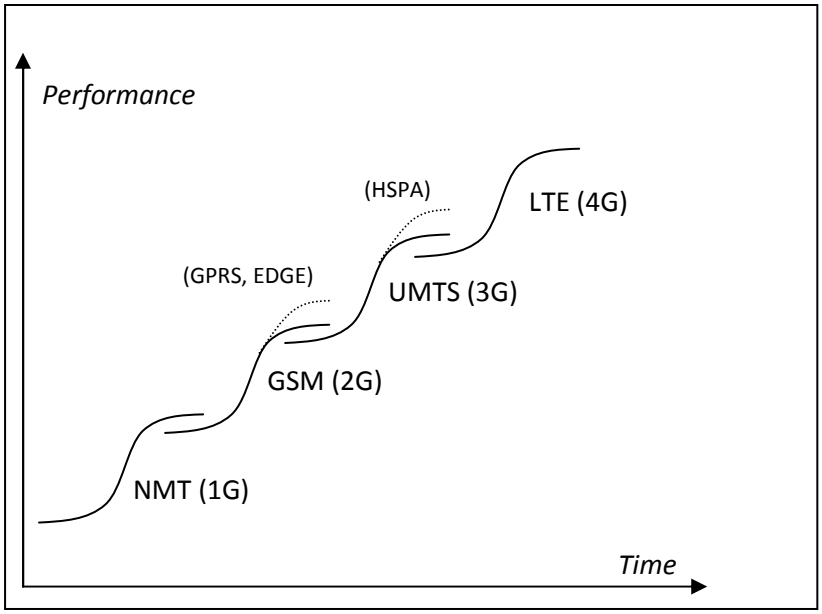

Figure 4 Technological life cycles in the 'ETSI-track' of wireless communications

Given that the US is lagging behind the European mobile telecom infrastructure, with recognizable implications for the US mobile equipment industry, there are strong incentives in the US market to promote decentralised WLAN based wireless Internet access solutions. The latter should be conceived as a supplement to the ordinary wired telecom infrastructure.[5] On this background there is a rapid process of technological change going on at present.

WLAN is, opposite to UMTS or CDMA2000, using unlicensed spectrum and is highly deregulated. One of the attractions is the possibility to build up small range high-speed wireless networks for low cost and avoiding the problem of carriers controlling the 'last mile'. But there are advantages and disadvantages with 3G as well as WLAN solutions. To summon a few, WLAN has higher speed, but is limited to hotspots, while the mobile networks are significantly slower but have much better coverage. The mobile networks allow the user to be moving.

The technological development within the convergence between wired and wireless communications is one of the fastest expanding areas with the ICT sector. Radically new products, applications and concepts are emerging nearly every week.

[5] A WiFi network starts with a DSL or other high-speed connection to the wired infrastructure. The connection is then linked with an access point allowing wireless access to the Internet by a WLAN card in the computer.

5.2 The NorCOM Cluster

The NorCOM cluster in wireless communications is located in Northern Jutland, Denmark. The regional employment specialization of the ICT sector in Denmark is shown in Figure 5. The data are based on private sector employment at the municipal level. The ICT sector is spatially concentrated in the regions surrounding the three university towns of Copenhagen, Aarhus and Aalborg, while no specialization can be detected for the fourth university town of Odense.

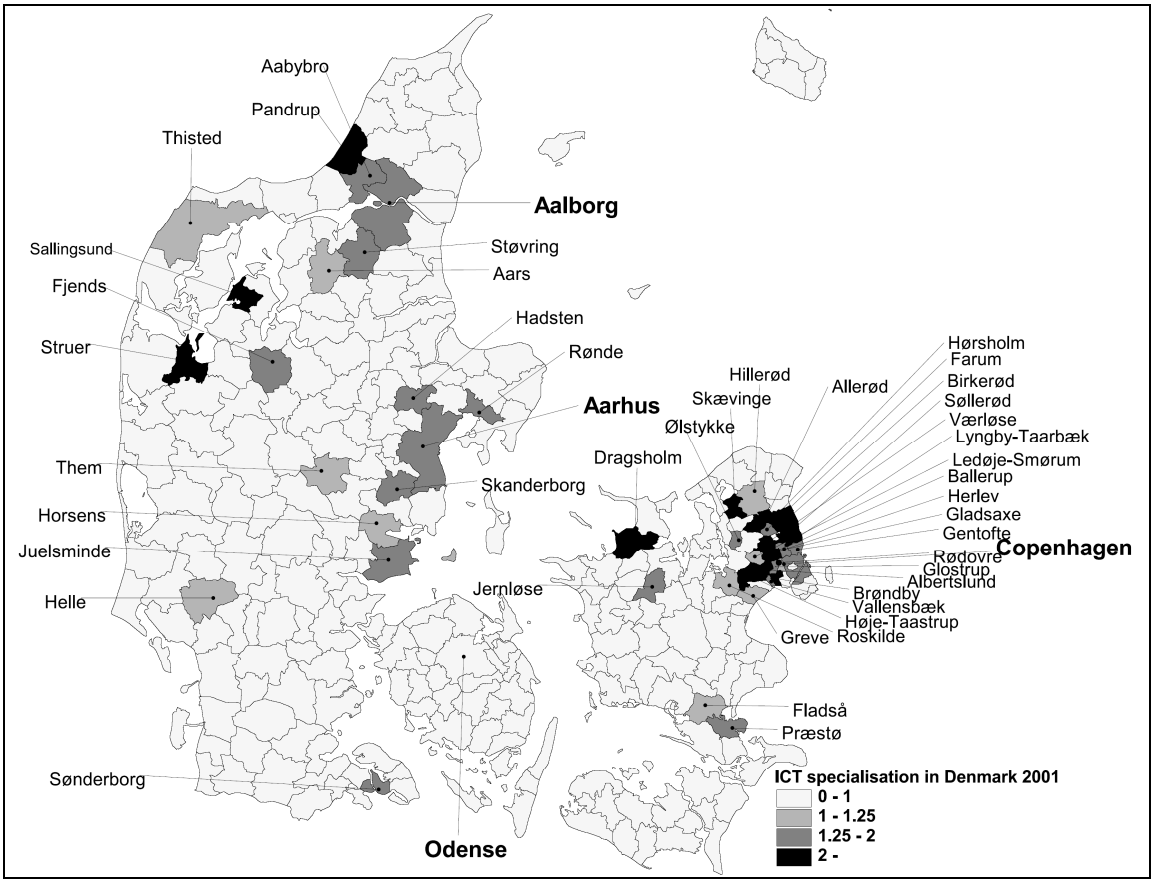

Figure 5 Geographic specialization of the Danish ICT sector 2001 – private sector employment. Source: (Pedersen 2005).

NorCOM consists of two related fields: mobile telephony (development and production of hardware and telecom services) and equipment for maritime communications and navigation. This cluster, called NorCOM from 1996, originates back to the mid 1960s when the 'mother' company SP Radio switched from being a consumer electronics producer for the domestic market to radio telephones for small ships. This firm quickly became one of the world leaders in its field.[6]

During the 1970s a few maritime communications firms emerged as spinoffs from SP Radio. At the beginning of the 1980s North Jutland had become visible in an industrial context as a maritime communications

[6] For details of the firms and the history of the cluster, including a 'family tree', see Dalum (1995) and www.norcom.dk.

and printed circuit board concentration. At the university the first M.Sc.'s in electronic engineering graduated in 1979 and research activities were growing rapidly. From the early 1980s the wireless communications industry embarked on a fast growth track initiated by the establishment of the first international cellular telephone system, the Nordic Mobile Telephony (NMT), which covered five Nordic countries. Demand grew very fast in these countries becoming the home nations for some of the world leaders in the field, especially Ericsson and Nokia.

Employment in the NorCOM cluster peaked in 2004 with 4,300 jobs. A major manufacturing plant of Flextronics was closed and the end of 2004. Around 1,500 jobs were laid off. Nonetheless, apart from the end of manufacturing of mobile terminals the NorCOM cluster has increased employment in development activities. Of the present 3,000 jobs the majority is development related jobs. Today NorCOM is a rather small, though internationally visible, development hub for wireless communications equipment. Many of the big international players are represented in the region, such as Motorola, Texas Instruments, Infineon, RF Micro Devices, Nokia Siemens Networks and Rohde & Schwartz.

As a major prerequisite for the evolution of NorCOM has been the build up of Aalborg University (AAU) since 1974. Two major research centers, Center for PersonKommunikation (CPK) 1993-2003 and Center for TeleInFrastruktur (CTIF), have been decisive behind the growth of the cluster.

5.3 Some important events shaping the NorCOM cluster

NorCOM emerged as a wireless communications cluster already during the 1G cycle in Figure 1. But the emergence phase was mainly a result of somehow random forces at play in industry and not an outcome of any 'master plan', c.f. Dalum (1995) and Østergaard, Dahl and Dalum (2007).

During the mid-1980s ideas of a joint European standard for mobile telephony emerged among the state owner telecom operators and was subsequently taken over by the EU sa a major prestige project for the Single Market, 'Europe 1992'. The advent of the GSM standard at the European level was orchestrated by the operators in collaboration with the major equipment producers. In a European context Ericsson and Nokia became the two dominating companies in the technical specifications of GSM, decided in 1987/88 by the newly founded EU telecom standardisation body, ETSI, and implemented from 1991/1992.

In the NorCOM context GSM was initially seen as a potential threat for the local SMEs involved in the mobile handset industry. GSM was a major technological challenge which implied a transformation to an all-digitalized system - 1G/NMT was analogue, while 2G/GSM was specified as digital. Seeing these perspectives in the horizon some of the main professors at Aalborg University tried to create collaboration – at the national level in Denmark – between the involved universities and four Danish companies. The latter were at the time Storno in Copenhagen, which was the no. 3 worldwide in so-called 'closed land mobile' radio technologies (mobile radiotelephones before 'open' public cellular systems were introduced starting with 1G. Storno was owned by General Electric, US, until 1986, when it was acquired by then world no. 1, Motorola. In Copenhagen a maritime radio company, AP Radio, had been taken over by Philips which entered mobile telephony. Furthermore there were two North Jutland companies invited to collaborated, Dancall and Cetelco.

No Danish university-industry collaboration was established between all of these companies. Motorola/Storno and AP Radio/Philips[7] did not accept a Danish collaboration model because their headquarters had other strategic aims. The two remaining local companies did however form a pre-competitive development joint venture in 1987/88, DC Development, which became located 1988-1992 in the newly established NOVI Science Parking, neighbouring Aalborg University. DC Development managed to develop on of the first four GSM terminals to be launched at the CEBIT Fair in Germany in 1992; the three others were developed by Motorola/ Storno in Copenhagen and Ericsson and Nokia in Sweden and Finland, respectively. North Jutland came on the world map within GSM technology right from the beginning. In parallel a major research centre, Center for PersonKommunikation (CPK) was built up at Aalborg University and became an internationally recognized research unit 1992-2002. CPK was especially important as a fertile breeding platform for research which made it possible for Aalborg University to deliver highly demanded masters in electrical engineering fit for fast product development at the world technology frontier in GSM technologies.

At the bottom-line, the lack of commitment from the MNCs in Denmark and the potential threat from GSM was transformed to a challenge that was successfully met by local actors in terms of the Danish owned companies, the university research environment and the formation of a new science park, which got a head-start by hosting the DC Development venture.

The two Danish companies became, however, financially drained by the GSM project and went nearly bankrupt, which resulted in acquisitions by to foreign companies and closing of DC development. The discussion in the region was focused at the possibilities for survival of he now recognized embryo of a cluster. The outcome was – instead of a deroute from the industry – a cloning process and considerable growth during the 1990s by some 6 companies in the GSM terminal business. During the late 1990s several of the major multinationals in the industry plugged into the region in terms of founding affiliates, such as Nokia, Ericsson, Texas instruments, Infineon; Analog Devices, RF Microdevices and Rohde & Schwartz. The cluster became consolidated as an international development hub and was dubbed NorCOM in 1996 and turned into a formal business association in early 2000.

In the late 1990s a new 3G standard emerged, the so-called W-CDMA or UMTS. NorCOM thus became exposed for yet another major technological threat or potential challenge. 3G became oversold internationally as the coming 'mobile Internet'. The advent of 3g coincided with – and became itself an endogenous part of – the burst of the dot.com bubble in 2000-2001. Again, major discussions in the NorCOM environment emerged focusing, once again, on the possibilities for the cluster to survive – this time within the auspices of the newly former NorCOM association. The latter collaborated with the science park about putting a think-tank together focusing on the future of the North Jutland ICT sector. The members were some of the major peers in the local wireless business community as well as IT service industry and two central professors within wireless communications and computer science at Aalborg University.[8] The think-tank proposed the university to go for an internationally recognized big research centre focusing on the coming 4G technologies, which at the time were only at a very preliminary stage. Already in the initial phase of 3G it

[7] Later to be taken over by Nokia. At present Nokia-Copenhagen this is the largest Nokia development unit outside Finland.

[8] One of the present authors acted as one of three secretaries drafting the report for the group, dubbed the 'North Star'.

was somehow evident that the NorCOM companies did not appear to be able to get the same prolific position as was the case within 2G/GSM in the early stage.

The essence of the thrust for a 4G research centre was the coming convergence between wired and wireless technologies. The actors in the region managed to collaborate on promoting the ideas of creating a Center for TeleInFrastructure (CTIF), which finally was brought about from 2004/05 by combining the role of AAU as coordinator of one of the biggest EU 6th framework research projects within 4G technologies, MAGNET, with sponsored free research money from local institutional funds.[9] CTIF has emerged as successor to CPK and represents a broad profile of approximately 100-120 researchers within telecommunications research.

Although the local industry has experienced the closing of all production activities within mobile communications, the private sector employment of R&D engineers with NorCOM has increased over the time-span from the late 1990s until at present. The region has managed to preserve its role as an international development hub within telecommunications – although relative small in terms of around 3000 persons.

6 Conclusion

One aim of the paper is to put the notion of governance, of power, into the typologies of clusters. The classification of these presented by (Markusen 1996) is relatively well suited to categorize snapshots of the cluster types we may encounter around the world. However, it falls short on two dimensions. We have intended to make an initial elaboration on these. The first is the world outside clusters, and how this world influences the evolution of clusters. The second is the power relations shaping the evolution process.

Cluster of different types do not exist in vacuum, i.e. we don't see clusters formed as a homogenous grey mass to be treated as the 'surrounding world'. Instead, they are parts of complex networks of localities, and we have to see this network and its evolution as a whole. One event in one locality, be that for example a region containing only one headquarter of a MNC, may cause things to change in other localities within that industry, be that for example a region containing a cluster consisting of local companies and MNC affiliates. We have discussed the power of the surrounding world and emphasized that discourses originating outside as well as inside a given cluster shape its evolution.

The second dimension, power, was made a function of company size by Markusen (1996), while the power shaping the evolution of satellite platforms were considered to be located outside these. Our discussion has indicated that it appears too simplistic to equalize company size to power. Using the notion of bio-power and disciplinary power we have argued, that it will to some extent be possible for actors in cluster of all types to create discourses and pursue strategies on their own. This argument was also supported empirically by showing how the notion of discourses pursued by different actors can be used to understand the evolution of a cluster - in our case how e.g. EU RTD funding may affect the evolution of a cluster in terms of playing a decisive role in formation of the CTIF research center.

For future research we would urge for more focus on the interaction of diverging discourses within clusters and how they may shape their evolution. We believe that this would represent a supplement to the current

[9] Nokia and Alcatel Lucent were among the MAGNET participants, while the local funds came from the Science Park NOVI, the Spar Nord Foundation and the Obel Foundation.

literature on cluster emergence which tend to focus on the 'hard facts' of regions, i.e. the knowledge resources available in the regions.

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